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PROBLEMS IN DETERMINING THE COST OF SOVIET WEAPONS SYSTEMS

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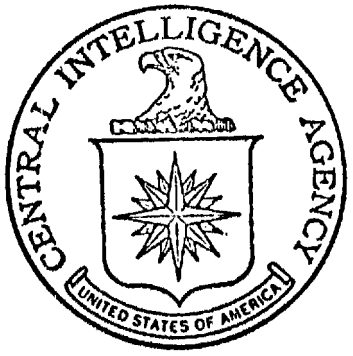

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A paper presented to the

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for the session on

Estimating Future Soviet Military Programs

by

[redacted] Chief, Military-Economic Division, ORR

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PROBLEMS IN DETERMINING THE COST OF SOVIET WEAPONS SYSTEMS

After looking at the subject for this discussion, you might ask, "What do the problems involved in determining the cost of Soviet weapons systems have to do with estimating future Soviet military programs?" These problems have traditionally been of primary, if not exclusive, interest to the economist and a relatively small group of people concerned with economic intelligence. Others tend to look at the results of such work and say, "So what?" In order to put the subject in perspective, let us examine some of the important intelligence considerations that are, or can be, influenced by estimates of costs of Soviet weapons systems.

I am sure that you are aware that the USSR has expended large amounts of resources in the past 5 years in establishing its current military posture. It has acquired hundreds of surface-to-air missile sites; deployed several hundred MRBM launchers; developed at least three ICBM systems, which it is deploying in force; built nuclear submarines with missiles; outfitted bombers to air-launch missiles; demonstrated advanced nuclear technology; and awed the world with space achievements. Within the next 5 to 10 years, the growth of some of these forces will continue, and technological advances will permit the development of an even wider variety of highly complex military and space systems.

Those of you who are even casually familiar with these new systems appreciate that the development, production, and deployment of such a system as an anti-ICBM weapons system and the implementation of technically feasible space programs are so expensive that even the richest countries will not be able to carry out simultaneously all feasible new programs on a large scale. The USSR is now faced, and will continue to be faced, with difficult economic decisions concerning these programs.

In considering the problems involved in the costing of Soviet weapons systems, I will discuss the following principal topics:

1. The factors affecting the over-all size of Soviet military expenditures,

2. The ways in which these expenditures can be categorized,

3. The elements that make up the cost of a weapons system,

4. The methods used and the problems encountered in costing Soviet military programs,

5. What we have concluded to date about Soviet military expenditures and the limitations to these conclusions, and

6. The outlook and the problems for the future.

In going through these principal topics, I also shall touch on such subordinate subjects as the "monetary illusion," international comparisons, and the Soviet defense budget.

I. Factors Affecting Total Military Expenditures

A. General

In the broadest sense the magnitude of Soviet military programs depends on the size of the Soviet economy and the extent to which the available economic resources are allocated to nonmilitary purposes. In allocating national resources, Soviet leaders have traditionally given the highest priority to the rapid growth of heavy industry and to the buildup of a strong military posture. What is allocated to popular consumption is essentially considered a cost of operating the economy. As such, consumers receive enough food, clothing, housing, durable goods, and services to insure that they are productive and acquiescent if not fully cooperative. In the post-Stalin period this cost has been rising as the Soviet people have become more educated and more aware of the levels of living in the West. The rate of growth of consumption, however, has been much less than that of the entire economy, and it is in the consumer-oriented programs of housing and agriculture that promises are broken when the availability of resources becomes tight.

In order to implement the primary goals of rapid industrial growth and strong military posture, the Soviet economy is planned to operate under "forced draft," where all the manpower, materials, capital, and managerial skills are fully committed. Unlike many Western economies, there are no large areas of unemployment and unused industrial capacity, such as steel, which can be marshaled to increase military production. The two primary objectives, industrial growth and military posture, are highly competitive for the same general types of resources. An increase in one must be at the expense of the other. They also are highly interdependent. Investment in industry increases the aggregate resources available in the future, part of which could then be allocated to the military. On the other hand, increases in the allocation to military programs decrease investment and the total resources likely to be available in the future.

B. The Monetary Illusion

Some time ago, I heard someone say, "We in the United States are arguing about the size of the military budget, while the Soviets can print all the money they need for military purposes." The idea that all the USSR has to do is to spend more money to get more military

goods and services is still around, although fewer people are confused by this monetary illusion. Increasing the monetary supply by deficit spending, the "printing press," or other fiscal measures is useful when unemployed resources can be brought into production. As I have said, all Soviet resources are fully committed, so that no significant increase in production is possible through these fiscal means. This statement does not mean that in some real sense all Soviet resources are "efficiently" employed. Increases in efficiency are certainly possible, but it is likely that the USSR would use primarily nonfiscal means for improving this efficiency.

Estimates of the costs of Soviet military programs can provide an appreciation of, and a possible check on, the size and the shape of existing Soviet commitments to military purposes. They also can serve as a means of testing future programs. In the past we have constructed estimates of total military expenditures by building up the costs implied in the physical estimates of Soviet military programs. These estimates of expenditures have been expressed in terms of so many billion rubles and in terms of shares of gross national product.

In costing past estimates of Soviet military programs, we found that the total military expenditures implied in these estimates often rose sharply for the year following the date of the estimate. Analysis of the estimates of Soviet forces showed that many of them were based primarily on estimates of requirements and that existing programs usually were assumed to continue at past rates. After a year had passed, we found that many of the estimates for that year were cut back and that the sharp rise in implied expenditures shifted to the next year. With military costing as a tool, we can now check the reasonableness of estimates based on requirements from an economic point of view, can examine the economic effects of changes in force structure, and perhaps can identify economic indicators of such changes.

We can think of the military's share of Soviet gross national product as a manifestation of Soviet preferences for military goods and services relative to those for other means of attaining Soviet policy objectives. These data reflect judgments as to how much potential growth in investment or consumption must be given up to increase military expenditures or the reverse -- how much other programs can be increased at the expense of military programs. In making such judgments, Soviet planners examine these costs along with the benefits to be derived and make their decisions accordingly.

Although analyses of past allocations to military purposes serve as background in judging how Soviet planners may make future decisions, they cannot be taken as the sole basis for estimating future allocations to defense. Conditions change, new weapons are developed, the military postures of potential enemies are altered, and different international and domestic environments evolve. The longer the time period under consideration, the greater is the number of possible situations that must be considered.

For example, in assessing the likelihood of the introduction of a large military program such as the widespread deployment of an anti-ICBM system, we must estimate how such a program would affect investment and industrial growth, what sectors of the economy would be most hard pressed, and how much civilian or military programs might have to be cut back. Soviet planners would certainly consider these factors in making their decisions, but they also would consider their estimate of opposing forces, how effective their anti-ICBM system is likely to be against Western missiles, and how many anti-missile units should be deployed and where. All these considerations will take place in an environment shaped by Soviet bureaucracy, custom, military doctrine, and personalities.

Thus the costing of military programs alone cannot yield a unique solution to the problem of future Soviet military programs, but cost analysis, carried out in conjunction with assessments of these other factors, can narrow significantly the number of reasonable alternatives. In order to bring these other factors to bear on the problem, we also must study (1) evolving Soviet military doctrine, (2) the effectiveness of potential weapons systems and the requirements for these systems, (3) the availability of resources in the various sectors of the economy, and (4) Soviet estimates of Western capabilities.

II. Military Expenditures

A. Categories

Soviet military expenditures can be categorized by military mission, weapons system, or economic sector of impact. An analysis of expenditures by mission can reflect Soviet preferences for various types of forces, such as those for air defense or strategic attack, and trends in allocations can assist in predicting the type of weapons that Soviet planners may emphasize in the future.

Within military missions the costs of competing weapons systems have an important role. Soviet planners may select one type of weapon like a surface-to-air missile system instead of a fighter air-to-air missile system on the basis of their relative costs and effectiveness. Often the decision may not be to exclude one of the systems but may involve the relative amount of effort devoted to each. Decisions within types of systems may be made similarly. With estimates of costs and effectiveness of potential weapons systems in hand, intelligence should be in a better position to make assessments of future Soviet decisions about these weapons systems.

Different weapons systems will have different impacts on the Soviet economy, although their total monetary costs may be similar. Simply put, the change from tanks and artillery of the postwar period to missile systems of the present has shifted the impact of military programs from the steel industry to the electronics industry. Several years ago, our analysis pointed up the fact that if the USSR were going to have large missile programs, its electronics industry would have to grow very rapidly. This growth did, in fact, take place. But the new weapons systems also require higher qualities of material and manpower not only for their development and production but also for their operation and maintenance. These probably are the kinds of problems that the USSR currently is facing, and we must make military costing methods more sensitive in order that they reflect the impact of these new developments.

B. International Comparisons

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Total Soviet military expenditures also may be valued in dollars [redacted]. Such a valuation is useful for giving the consumer of intelligence an appreciation of what the Soviet assortment of military goods

and services purchased in a given year would cost in the US [redacted]. 25X1C
Soviet military expenditures in dollar terms can be broken down by mission, weapons system, or category of goods purchased and can be compared with similar US expenditures. Costing of Soviet weapons systems in dollars introduces a whole set of analytical problems. As is the case with almost all international aggregative economic comparisons, however, the relationship between US and Soviet military expenditures in dollars should be viewed only as a very general indicator of magnitudes that implies little if anything about the relative effectiveness of the military programs of the two countries.

III. Cost Elements of Weapons Systems

Conceptually the cost of a weapons system should include all expenditures associated with developing, testing, producing, deploying, and operating that system throughout its useful life. In other words, what is desired is an accounting for the expenditures that would not have occurred if a given weapons system program did not exist. Operationally, we divide the cost into two categories: initial cost and annual operating cost.

In order to illustrate, I will describe what is included in each of these two major categories of cost for an ICBM weapons system. The initial costs of such a system include the expenditures for research and development of the concepts and hardware associated with that system, the costs of missiles tested at the range, and the costs for developing and testing special ground-support and guidance equipment and special nosecones. The initial costs also include those for constructing roads and facilities at deployed sites, all hardware (both special and general purpose) that is present at the site, initial issues of spare parts and fuels, and nuclear warheads allocated to that ICBM system. Even the cost of the initial training of operating personnel falls in this category.

The annual operating cost of an ICBM system includes recurring expenditures such as the pay and allowances of military personnel assigned, the cost of replenishing supplies of fuel and spare parts, and the costs of all other goods and services necessary for keeping the weapons system in operating order.

IV. Costing Methods and Problems

It should be clear from this description that we either must have broad access to Soviet accounting data or must know quite a lot about detailed components of such a system in order to determine its cost. The fact is that our knowledge in these two areas varies from cost element to cost element and from system to system. Direct information on Soviet prices is available for the major portion of our estimates for personnel, construction, fuels, and general-purpose equipment such as trucks and common communications equipment.

Indirect pricing methods are used for estimating the costs of most of the weapons themselves. There is a whole spectrum of indirect costing methods that have been used. At one end of the spectrum, where we can determine most of the physical and performance characteristics and are familiar with production techniques and costs, we can construct the cost directly in Soviet prices in much the same manner as it is done in the USSR. At the other end of the spectrum, where we know little about the physical characteristics of the weapon and its Soviet costs, we have been forced to use the costs of similar US weapons and have attempted to modify these by the obvious differences between the two.

Let me describe how we estimated the cost of one of the Soviet jet heavy bombers indirectly. In this case we asked one of our consultants employed at a large US aircraft firm to estimate what it would cost in the US to produce various quantities of this aircraft. To assist him in this work, we furnished him with a very detailed description of the aircraft, its engines, electronics, and other components and supplied him with as much information as was available on the manufacturing facilities that we believed were employed in its production. We also discussed with him what was known of Soviet aircraft production techniques. This project resulted in a study that presented a cost estimate not only of the whole aircraft but also a breakdown of the cost by major component. It also showed how these costs varied with the volume of output. We then were able to take these data in dollars and convert them to ruble costs on the basis of our knowledge of relationships between US and Soviet prices for the various components of the aircraft.

This problem was a relatively straightforward exercise where much was known about the weapon itself and its producing plant and manufacturing methods. In other cases where less is known about these factors,

a large number of assumptions have to be made, thus increasing the ranges of uncertainty surrounding estimates of cost. One of the obvious problems facing us is to improve these estimates either by getting direct Soviet cost data or by determining the difference between US and Soviet systems more accurately. In the few instances where actual Soviet prices have become available, our indirect prices have turned out to be surprisingly good. For many weapons, such as naval vessels, aircraft, and some ground armaments our cost estimates probably are relatively accurate.

It is in the important areas of new weapons and research and development, however, that our knowledge of costs is the weakest. Research, development, testing, and evaluation have become major elements of the cost of new weapons systems. Before the advent of missiles, a country could produce 5 or 10 prototype aircraft and reuse most of them in a development program. Some of these might even be modified later and assigned to operational units. Such costs were only a small part of the total cost of the program. Missile systems are different. A research, development, test, and evaluation program can consume 50 or even 100 very expensive missiles. In addition, extensive instrumentation is necessary to gather performance data. For missile systems these costs constitute a major portion of the total program.

Furthermore, the introduction of missiles has created new deployment and operational problems. A new aircraft usually can be deployed on existing fields and can use much of the equipment already present, although the runway may have to be modified and some new equipment may be added. The introduction of missile systems has required the USSR to establish entirely new launching complexes and to furnish them with completely new equipment.

A. Timing of Expenditures

One of the most difficult problems that we face in costing Soviet programs is the determination of the time period in which various expenditures are made. The timing of these expenditures is important to understanding the impacts of these programs and the fluctuations that are manifest in Soviet economic data. The new complex weapons systems require long leadtimes for development, production, and deployment. Often these costly activities for a particular program may be underway long before we are aware of the existence of the program. Even after we become aware and can estimate its total cost, we must allocate these expenditures to the years in which they actually occurred. We can usually determine from US experience and knowledge of previous Soviet

programs some minimum time dimensions. In addition, various sources of intelligence, when viewed in retrospect, reveal significant indications of the timing of such programs. Generally, however, adjustments on this basis are made after the events have occurred, and, obviously, such omissions limit the usefulness of our estimates of expenditures.

In order to illustrate this problem, let us consider the effects of a Soviet program to land a man on the moon before the end of the decade. If such a program exists, very large expenditures would have to be occurring right now for large boosters and for other hardware and facilities necessary for this program. These expenditures might cumulate to a sum on the order of one-half billion to 2 billion dollars to date and would grow to several billion a year before the actual event. Yet it may be a year or two before we get evidence from Soviet test activity that such a program is underway. This problem can be handled by presenting two estimates of expenditures: one with the moon program and one without.

B. Soviet Defense Budget

How do our estimates of Soviet military expenditures compare with those announced by the USSR? For the 1958-62 period, our estimates are about 40 percent greater. Why should such a discrepancy exist? The primary reason is that much of what we consider military expenditures is included in other accounts in the Soviet budget. We are relatively certain that announced Soviet military expenditures include those for general "housekeeping" functions such as pay and other personnel costs and maintenance and operations. They also may include those for some facilities such as barracks, for general-purpose equipment such as trucks, and for the replacement of certain operating stocks such as ammunition and fuels. On the other hand, some, if not all, of the expenditures for research, development, and testing; the space programs; the purchase of new weapons and nuclear warheads; and the construction of some military facilities probably are financed from other budget accounts such as "science" and unspecified residuals.

A comparison of announced expenditures for 1960 and 1962 supports this view and also indicates that the scope of the announced "Defense" account may have been changed in 1961. Our estimates of military and space expenditures increased by about 20 percent between 1960 and 1962, while the planned Soviet defense vote increased by about

40 percent, or 3.8 billion rubles. At the same time, the unspecified budget residuals, which usually rise from year to year, decreased by 2.6 billion rubles. Thus at least two-thirds of this increase in the defense vote could be accounted for by a simple redefinition of accounts.

V. Conclusions to Date and Their Limitations

A. Conclusions

After hearing some of our problems, you might ask, "How good are our estimates of Soviet military expenditures? Can they tell us anything about Soviet activities to the present?" Our estimates of Soviet military expenditures are certainly not perfect, and much more work has to be done to improve them. Yet they are very useful for understanding what has happened to Soviet military programs over the past few years.

After declining from 1955 to 1957, Soviet military expenditures grew very rapidly to the present, reflecting the large expenditures on research, the introduction of new weapons systems (especially missiles), and the increased availability of nuclear warheads. Total military expenditures increased by about one-third since 1958 at an annual rate half again as fast as Soviet gross national product.

Most of this increase was from the machinery sector of the economy. During the 1958-62 period the machinery component of military expenditures grew from about 50 percent to about 62 percent of the total, reflecting a trend that is likely to continue into the future. The increase in the machinery intensity of military expenditures since 1958 has caused a reduction in the rate of growth of nonmilitary machinery, thus affecting industrial investment and the future growth of Soviet industry. Significant changes must have taken place in that part of the manufacturing sector of the Soviet economy which supports the military establishment. Expenditures for the procurement of missiles, ground electronics, and nuclear warheads probably will be significantly larger in 1962 than all military hardware procurement in 1958. The growth in output of these complex products in the last 5 years certainly required large new investment in plant and equipment.

Before discussing what our calculations show about the relative importance of the various missions, let me describe the mission categories that we use and what is included in each. There are four major combat missions -- ground, naval, air defense, and strategic attack. There is a category of expenditures for military research, development, testing, and evaluation that also includes expenditures for all space activities. Finally, I have grouped all other expenditures into one broad category that includes expenditures for over-all

command and support activities, other expenditures which are not appropriately assigned to other categories, and a residual set of expenditures such as pay for retirees and the cost of the reserve system.

It should be noted that the expenditures for research, development, testing, and evaluation are not included in any of the combat missions. Each of the combat missions includes an aircraft element. Finally, I would like to point out that not all naval vessels are in the naval mission -- for example, submarines with ballistic missiles are included under the strategic attack mission.

Our calculations show that the USSR is allocating the smallest share of its military expenditures to the naval mission and the largest to the ground mission, although this latter share has declined greatly in the last 5 years. During this same period, expenditures for research, development, testing, and evaluation -- including the space program -- have doubled and probably will exceed those for the ground mission next year. I shall have more to say later about expenditures for research and development.

Allocations to the air defense and strategic attack missions have more than doubled since 1958, and these two missions are now about equal, although air defense probably will become a somewhat larger share in the future. Even within the strategic attack category a useful distinction can be made -- historically, weapons systems for attack against Eurasia and the periphery have received by far the larger slice, but at present those for intercontinental attack have grown to absorb almost an equal share.

B. Limitations of Our Estimates of Expenditures

As I have said, our estimates of Soviet military expenditures are not perfect, and much more work has to be done to improve them. I believe that any bias which they may have tends to be downward. There are several reasons for this statement. First, the method of compiling these expenditures by cumulating the costs of activities estimated to exist, by its very nature, cannot really take account of programs that we know nothing about. Second, in those areas where we have no direct Soviet price data we may underestimate the cost. Some of us believe that the ruble-dollar ratios which apply to conventional weapons may be too low for the newer weapons systems where the USSR is pushing technology. Such a statement would imply that the USSR is relatively less efficient in producing these new weapons than is the US.

On the other hand, there are some compensating factors. These include our tendency to estimate the continuation of old weapons programs too long and our frequent overestimates of the number of units of a weapons system that the USSR may acquire.

Costing military programs in rubles has been criticized as not reflecting the "true" economic cost of these programs to the USSR. Soviet prices do not include charges for rent and interest on capital, and allowances for depreciation of equipment generally are too low. Prices paid for the high-quality materials and workmanship used by the military may not adequately reflect their true scarcity in the Soviet economy. Finally, the pay of a large portion of military personnel does not represent the opportunity cost of the men -- that is, what they probably could produce if they were employed in industry or agriculture. All these criticisms are true, but Soviet planners probably use these monetary data together with other information in physical terms to reach their economic decisions.

VI. Outlook and Problems of the Future

So far I have discussed our estimates of military expenditures up to the present. How far can they be projected into the future with confidence? What new problems are introduced?

Our evidence on production, construction, and test activity, together with our understanding of leadtimes and our interpretation of Soviet trends, permits a reasonably valid projection extending about 2 years into the future. For the period beyond that, the evidential base almost disappears, and new problems are introduced.

In view of the long leadtimes involved in the development, production, and deployment of modern weapons systems, military planners must make decisions now that determine the composition and strength of our military forces 5 to 10 years from now. One of the principal factors affecting our force structure in that time period should be reasonable estimates of alternative force structures which our likely enemies may have. To date, however, intelligence has had little influence on these long-run decisions in the US, but there is much that it can contribute.

In order to be useful, intelligence must assess the factors that Soviet planners must consider in reaching decisions on their forces for that time period. Earlier in my discussion I named some of these. They include (1) evolving Soviet military doctrine, (2) Soviet estimates of Western capabilities, (3) the effectiveness of and the requirements for potential weapons systems, (4) the costs of these weapons systems, and (5) the availability of resources in various sectors of the economy.

What we who are involved in costing must do is to construct alternative estimates of Soviet military expenditures implied by the various feasible military programs that the USSR may undertake in the future. We must then select those force structures that appear most reasonable in the light of the factors which I have just listed. Because of the leadtimes involved, subsequent intelligence on weapons tests, production, and deployment activities, together with developments in specific sectors of the Soviet economy, may help reduce the number of alternatives even further. Obviously, some judgment concerning the economic consequences of each of these projected force structures should be made in terms of their effects on growth in investment and consumption.

A most pressing problem is how to cost new weapons system that have not yet been developed by any country. In deciding on whether to develop and deploy some unspecified weapons systems to perform a particular mission, national planners must make some estimates of what it would cost. Costs of many such programs have been estimated for US planning purposes. Presumably, such costs, properly modified, could be used in evaluating the impact of similar programs on the Soviet economy. A review of estimates for US programs which have been made in the past and have since been implemented clearly shows a pervasive downward bias. In fact, actual costs have been several times what had been estimated. The indiscriminate use of such estimates would involve a severe downward bias in estimates for Soviet programs. Similarly biased estimates, however, might even be the basis for Soviet decisions. How to estimate costs of weapons systems for periods 5 or more years in the future is currently being studied for US programs, and much of this work may be applicable to intelligence problems.

A key consideration in assessing future Soviet military programs is the allocation of resources between expenditures for current and near-term operations and those for research on weapons concepts and components for the far term. Soviet research and development expenditures have quadrupled in the past 8 years and next year will be larger than those allocated to the ground mission. Much of this growth is certainly attributable to the increased cost of developing and testing systems that are now or will soon become operational. Part of the growth is due to major exploratory research and development activities whose fruits will not become operational or even apparent for another 5 or 10 years. The important intelligence questions are (1) how much near-term operational capability is being sacrificed in order to acquire significantly improved weapons systems in the future and (2) how successful will the USSR be in this respect. We have earmarked expenditures for Soviet research, development, and testing as a primary area of study during the next year.

VII. Summary and Other Questions

I have presented some of the intelligence uses to which estimates of costs of Soviet weapons systems can be put in assessing over-all Soviet policy decisions and in understanding the allocation of resources among military missions and weapons systems. The major objective is to give our intelligence community and the policymaker an appreciation of the magnitude of resources which the implementation of various weapons or space programs will require and which, therefore, will not be available for carrying out other military or nonmilitary programs. Soviet leaders in formulating their policy decisions -- and therefore the intelligence community -- must assess these costs in terms of (1) the gains to be acquired by such military programs and (2) the other potential benefits that will be given up. I also have discussed some of the major problems that we face in determining the costs of weapons systems. There are many more that we might explore in the discussion period. These might include how weapon costs change with the volume of production, the problem of the ruble-dollar ratio, joint costs, or the usefulness of the prices quoted for weapons to underdeveloped countries. We might go into some more general problems of how decisions about funds for weapons systems are made in the USSR or even into the meaning of Soviet prices as a real measure of economic cost.